San José State University
College of Science / Computer Science Department
48249, Introduction to Database Management Systems, CS 157A-05, Fall, 2016

Course and Contact Information

Instructor:	Thanh Tran
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Office Hours:	Monday 1:30 – 3:30, please drop me email with time info and subject
Class Days/Time:	MoWe 9:00AM - 10:15AM
Classroom:	MacQuarrie Hall 222
Prerequisites:	Prior database knowledge is not required. However, students should have taken CS 146 Data Structures and Algorithms. Also, familiarity with team projects and programming is beneficial.

Course Format

Technology Intensive, Hybrid, and Online Courses

Leveraging the increasing availability of high quality online learning materials, this course follows a "hybrid" approach, which consists of self-paced online learning, team-based project work and class meetings.

For every topic, there are online videos, automated assignments and project work students will use to learn and apply their knowledge to real-world problems on their own. In class meetings, we will then discuss the learning materials, assignments and project-related issues, focusing on what's really difficult, interesting and relevant from the students' point of view.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at http://sites.google.com/site/kimducthanh and/or on Canvas Leaning Management System course login website at http://sjsu.instructure.com.

Course Description

General: Current, classical database systems. Entity-relationship and enhanced entity models. Relational model, algebra, calculus. Current, emerging SQL standard. Embedded, Dynamic SQL. Application perspective on transactions and security. Interactive and programmatic interfaces to database systems. Application programming project using commercial database system. Prerequisite: CS 146 (with a grade of "C-" or better); Computer Science, Applied and Computational Math, or Software Engineering majors only; or instructor consent.

Course-specific: Database systems represent the primary choice for managing large amounts of data. This course is an introductory course in database systems focusing on the application-related aspects of designing, administering, tuning and using databases for engineering data-intensive applications. Students will learn how to design a relational database schema, to create database tables and populates them with real-world data, to use the standard language (SQL) to query the data, to access the data from the application, and to tune the database for specific applications (through schema redesign and creation of indexes and views). A variety of advanced topics important to database design and application development will be covered, including constraints, triggers, views, indexes, transaction and authorization. While the course primarily focuses on relational databases (SQL), it also introduces students to advanced and emerging technologies such as XML, XQuery, XPath, JSON, RDF, SPARQL, OLAP and NoSQL.

Course Learning Outcomes (CLO)

This course aims to introduce students to database systems, focusing on the main concepts important to database design and database application development.
In particular, it aims to teach students

- about the purposes and applications of database systems
- about different types of databases (relational, transactional, big data)
- how to design and tune databases (schema, index, normalization, view, trigger, constraints)
- and how to use the database (querying, application-level data access, transaction, security, authorization) as the backend for data-intensive applications

Required Texts/Readings

Textbook

No textbook is required for the course.

Other Readings

Students are encouraged to augment and reinforce their learning using course materials and online resources of the following similar courses:

- Introduction to Databases, CS145, Stanford, Prof. Jennifer Widom
- CS 437/537 Database Systems,
- Database Systems, 6.830 / 6.814, MIT, Prof. Samuel Madden, Prof. Robert Morris, Prof. Michael Stonebraker and Dr. Carlo Curino

Course Requirements and Assignments

The main topical requirements for the course are:

- Purposes, common usages and applications of database systems
- Data: relational data model, relational design theory, XML, JSON, RDF
- Query: relational algebra, SQL, XPath, XQuery, SPARQL
- Core database concepts: indexes, transactions, constraints, triggers, views
- Database systems: relational, transactional, analytical (OLAP), Big Data (RDF, NoSQL)
- Database applications: authorization, application-level database access (ODBC, JDBC), object-relational mapping (Hibernate) and data-access objects

For every topic an online assignment is provided to test every student's knowledge.

In additional, this course features a semester-long project. The project can be conducted individually or collaboratively (in teams with up to 3 members). Besides project examples and recommendations, students are encouraged to propose and pursue their own projects.

Project

The minimal requirements for the project are:

- Database design, creation and population: students will identify one or several publicly available datasets they want to use to develop their applications (seehttp://www.kdnuggets.com/2011/02/free-public-datasets.html and http://bigdata-madesimple.com/70-websites-to-get-large-data-repositories-for-free/). According to the structure and content of the data, they will design an appropriate schema and import the data into a relational database (this may require scripts to transform the data from its XML form into the load file format supported by the relational database).
- Database querying: students will create a set of queries and updates to retrieve from and add information to the database.
- Database tuning: students will experiment will different tuning techniques, including schema redesign and view/index creation

Additionally, students will incorporate some of the following advanced functionalities:

- Database integrity, security and authorization: students will use constraints and triggers to incorporate integrity checking into their database and demonstrate usage of security and authorization features provided by the database system.
- Application-level data access: students will access the database from the application using program-level interfaces (ODBC/JDBC, object-relational mapping).
- Interface: students create a front-end to expose their data. They will use their creativity to implement application functionalities that make use of the data.
- Transaction management

The progress of the projects will be documented in a report and discussed in class. There are two slots for teams to present their project in class (midterm + final presentation). For the 5 parts below, every project member is expected to report his / her own contributions.

The project report / presentation covers

- Project Overview
    - Team, idea, goals
    - Application architecture and main components
    - Task and task allocation
- (1) Schema Design
- (2) DB Setup
    - Creation, load and import
- (3) DB Operation
    - Query, update
- (4) DB Tuning
- (5) Advanced
    - Data access layer
    - Integrity, security and authorization
    - Transaction management
- Lessons learned

Grading criteria for project (every project member is graded individually based on their contributions reported in class / on paper):

- Checkpoint meetings: overall pacing and consistent work (10%)

- Overall project quality (60%)
    -
    - Design, Setup, Operation, Tuning, Advanced
- Final written report, 15-20 pages (10%)
- Final team presentation & demo, 15 + 15 min (20%)

Examples:

- Applications making use of data.gov datasets, see citizen-developed apps and mobile apps
- Applications making use of data provided by the Santa Clara Public Health Department

Final Examination or Evaluation

There will be one midterm exam and one (non-comprehensive) final exam. The date of the midterm exam is subject to change. The final exam date is firm and cannot be changed. No make-up exams will be offered.

Grading Information

Determination of Grades

The components of the final grade will be distributed as follows:

- Assignments (quizzes, database exercises): 15%
- Database project: 40%
- Midterm exam: 20%
- Final exam: 25%

Late progress will result in lower score (see scores for pacing etc.).

Each assignment, project, and exam will be scored (given points) but not assigned a letter grade.
Final individual class letter grades will be assigned based on the class curve.
Your final class grade can be adjusted up or down depending on your level and quality of class / project participation.

Classroom Protocol

Attendance is not required. Late attendance or any behavior (such as usage of cell phone) that leads to distraction should be avoided.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/

48249 / Introduction to Database Management Systems, Fall 2016, Course Schedule

This schedule is subject to change with fair notice. Please check your Canvas (https://sjsu.instructure.com) for announcements.

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	08/24/16	Purposes and applications of database systems Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDRFNoUWpNZDhPMW8, https://lagunita.stanford.edu/courses/DB/RDB/SelfPaced/courseware/ch-introduction/seq-vid-introduction/ Assignments: Form 3-member team
1	08/29/16	DATA: relational data model Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDdmtnMUQtWWxQZ28, https://lagunita.stanford.edu/courses/DB/RDB/SelfPaced/courseware/ch-introduction/seq-vid-the_relational_model/, https://lagunita.stanford.edu/courses/DB/RDB/SelfPaced/courseware/ch-introduction/seq-vid-querying_relational_databases/ Assignment: Discuss project ideas
2	08/31/16	DATA: XML Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDdmtnMUQtWWxQZ28, https://lagunita.stanford.edu/courses/DB/XML/SelfPaced/courseware/ch-xml_data/ Assignment: XML Quiz + DTD Exercises
2	09/07/2016	DATA: RDF, RDFS, JSON Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDdmtnMUQtWWxQZ28, https://lagunita.stanford.edu/courses/DB/JSON/SelfPaced/courseware/ch-json_data/ Assignment: JSON Quiz
3	09/12/2016	Project Proposal Presentations & Discussions
3	09/14/2016	Relational Design Theory 1 Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDekhPMXRENHN2XzQ, https://lagunita.stanford.edu/courses/DB/RD/SelfPaced/courseware/18c87a89721d4284840f5c8537c6afb3/

Week	Date	Topics, Readings, Assignments, Deadlines
		Assignments: Functional Dependencies Quiz, Normalization Quiz, Multivalued Dependencies Quiz
4	09/19/2016	Relational Design Theory 2 Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDekhPMXRENHN2XzQ, https://lagunita.stanford.edu/courses/DB/RD/SelfPaced/courseware/18c87a89721d4284840f5c8537c6afb3/
4	09/21/2016	QUERY: Relational Algebra 1 Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U, https://lagunita.stanford.edu/courses/DB/RA/SelfPaced/courseware/ch-relational_algebra/ Assignments: Relational Algebra Quiz + Exercises
5	09/26/2016	QUERY: Relational Algebra 2 Project Discussion: Schema Design Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U, https://lagunita.stanford.edu/courses/DB/RA/SelfPaced/courseware/ch-relational_algebra/
5	09/28/2016	QUERY: SQL 1 Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U, https://lagunita.stanford.edu/courses/DB/SQL/SelfPaced/courseware/3d4b35a7e27b48d99f190cdcfcb40db8/ Assignments: Social Network + Movie Rating Query Exercises (Extras parts are optional), Social Network + Movie Rating Modification Exercises
6	10/03/2016	QUERY: SQL 2 Project Discussion: DB Setup Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U, https://lagunita.stanford.edu/courses/DB/SQL/SelfPaced/courseware/3d4b35a7e27b48d99f190cdcfcb40db8/
6	10/05/2016	QUERY: XQUERY, XPATH 1

Week	Date	Topics, Readings, Assignments, Deadlines
		Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U, https://lagunita.stanford.edu/courses/DB/XPath/SelfPaced/courseware/47b6241e4a9e4c23a00ebe2375c3227b/ Assignments: Course Catalog + World Countries Exercises (Extras parts are optional)
7	10/10/2016	QUERY: XQUERY, XPATH 2 Project Discussion: DB Operation (Retrieval) Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U, https://lagunita.stanford.edu/courses/DB/XPath/SelfPaced/courseware/47b6241e4a9e4c23a00ebe2375c3227b/
7	10/12/2016	QUERY: SPARQL Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDUzlaWm1LUndUQ1U
8	10/17/2016	Project Proposal Discussion: DB Operation
8	10/19/2016	Midterm Project Presentations
9	10/24/2016	Midterm Project Presentations
9	10/26/2016	Midterm Project Presentations
10	10/31/2016	Midterm Exam
10	11/02/20161	Indexes & Views Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDMUxBZ0xHQ254RU0, https://lagunita.stanford.edu/courses/DB/Indexes/SelfPaced/courseware/ch-indexes/, https://lagunita.stanford.edu/courses/DB/Views/SelfPaced/courseware/c21a486318cd459da945e5c7ecf40f3f/569982a71284441fb2e25151d726cd72/ Assignments: Indexes Quiz, Views Quiz, Movie Rating View Modification Exercises
11	11/07/2016	Constraints & Triggers Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDMUxBZ0xHQ254RU0, https://lagunita.stanford.edu/courses/DB/Constraints/SelfPaced/courseware/58cba8bf051848dd8f4d6269cdd2673f/47cdb57a3fe54d43b50f499e7eb441c4/

Week	Date	Topics, Readings, Assignments, Deadlines
		Assignments: Constraints and Triggers Quiz, Social Network Triggers Exercises
11	11/09/2016	Transaction Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDMUxBZ0xHQ254RU0, https://lagunita.stanford.edu/courses/DB/Indexes/SelfPaced/courseware/ch-indexes/ Assignments: Transaction Quiz
12	11/14/2016	Authorization Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDMUxBZ0xHQ254RU0, https://lagunita.stanford.edu/courses/DB/Views/SelfPaced/courseware/c21a486318cd459da945e5c7ecf40f3f/ Assignments: Authorization Quiz
12	11/16/2016	OLAP Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDeEs0eGR4MnhhYWc, https://lagunita.stanford.edu/courses/DB/OLAP/SelfPaced/courseware/8588175ff82740898cf04d98f6bc6af6/0280c8b4d8ca45c2907d65a9d7c37bc8/ Assignments: OLAP Quiz
13	11/21/2016	Different Types of Databases Readings: https://drive.google.com/open?id=0BzbxhrIWrCCDeEs0eGR4MnhhYWc
13	11/23/2016	Project Discussion: Advanced DB Operation (Transaction, Authorization)
14	11/28/2016	Project Discussion: Final Report & Presentation
14	11/30/2016	Final Project Presentation
15	12/05/2016	Final Project Presentation
15	12/07/2016	Final Project Presentation
16	12/12/2016	Exam Preparation & QA
Final	12/15/2016	7:15-9:30